Explanatory visualization of multidimensional projections

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PROPOSITIONS
belonging to the thesis
EXPLANATORY VISUALIZATION OF MULTIDIMENSIONAL PROJECTIONS
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1. Projections are efficient instruments for the visual exploration of high-dimensional datasets, and can be used as "proxies" for the interpretation of the original data, but a major obstacle to their effective practical usage is their difficult interpretation.
2. Projection errors (inconsistencies between the original high-dimensional data and its low-dimensional representation) negatively affect the desired "proxy" effect, and thus need to be made explicit to the user: where they occur, how large they are and which interpretation aspects they affect.
3. It is possible to visually augment projections in order to make it easier and more effective for users to comprehend its visual patterns in terms of the data's original attributes.
4. Effective visual enhancements for improving any aspect of the interpretation of projections should be easy and quick to comprehend, shielding the user from any specific knowledge on how a projection method works internally.
5. Different regions of a projection can have different features, so it is important that visual enhancements of projections let the user decide when she needs a global (coarse scale) view of the dataset or a local (fine scale) view of specific regions, according to her exploration goals.
6. For some tasks, such as finding and reasoning about point groups and outliers in a projection, actual distances between points are less important than the neighborhoods of points.
7. Contrary to what is usually accepted, three-dimensional projections can still be very useful alternatives to two-dimensional projections when enhanced with proper visual explanatory features.
8. Multidimensional datasets with different types of attributes, such as multivariate networks that include both relational and quantitative attributes, can also be effectively explored with the use of projections.
9. A good visualization technique must do more than present known features of the data in a graphical way; it must allow new features to be perceived in a way that would not be possible without the reasoning supported by the human vision.
10. "Information visualization is a tool in search of an application" [1], therefore visual analytics research must focus on building a bridge between state-of-the-art information visualization research and its real potential practical applications and users.

[1] Orlena C. Z. Gotel, Francis T. Marchese and Stephen J. Morris. *The Potential for Synergy between Information Visualization and Software Engineering Visualization*. 12th International Conference Information Visualization, 2008.